

# **Working with Reference Materials in Nucleonica**

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# Uranium Isotopic Reference Material SRM 071

- Nuclide Mixtures – Create the SRM mixture
- Decay Engine – Nuclide composition today (or any other date)
- Decay Engine – Activity at creation time and today or any other date
- Dosimetry & Shielding – dose rate, gamma lines at creation time and today
- GSG – Gamma spectra at creation time and today
- Cambio File Converter to compare

# Uranium Isotopic Reference Material SRM 071

- On **1. July 1977** 200 g of natural uranium sample chemically separated and has been prepared as SRM 071
- Create the SRM 071 mixture in Nucleonica
- Show the nuclide composition **today**
- Compute the activity at the **creation time** and **today**.

### Application Centre

- » Mass Activity Calculator
- » **New:** Mass Activity Converter
- » Decay Engine
- » **New:** Decay Engine++
- » Dosimetry & Shielding
- » Range & Stopping Power
- » In Silico Dosimetry
- » webKORIGEN
- » Decay Engine for Large Nuclide Sets
- » Universal Nuclide Chart
- » Transport & Packaging
- » **New:** e-Ship: radiological transport assistant
- » Nuclide mixtures ←
- » Nucleonica Scripting
- » Gamma Spectrum Generator
- » Gamma Spectrum Generator Pro
- » Virtual Cloud Chamber
- » Cambio file Converter
- » WESPA
- » **New:** WESPA2
- » Gamma Library
- » webGraph

### Data Centre

- » Physical Constants
- » Nuclide Explorer
- » Nuclide Datasheets (Reference Data, Derived Data, Cross Sections, Radiations)
- » Nuclide Search / Radiation Search



## Nuclide Mixtures

[Getting started](#)  
[Reference manual](#)

My Mixtures

Edit

Upload

Sample Mixtures

Name

SRM 071 U isotopes separated 1. July 1977

Description:

200 g natural uranium (U234, U235, U238) with isotopes fractions corresponding to the

Nuclide	Activity(Bq)	Mass(g)	Number of Atoms	Mass ratio	Mole ratio	Activity ratio	Delete
(add a new Nuclide)							
92 U 234	2.443e+6	0.01062	2.732e+19	5.310e-5	5.400e-5	0.4860	
92 U 235	1.138e+5	1.423	3.645e+21	7.114e-3	7.204e-3	0.02264	
92 U 238	2.469e+6	198.6	5.023e+23	0.9928	0.9927	0.4913	
Total: 3	5.026e+6	200.0	5.060e+23	1.000	1	1	

Significant figures: 4

Element

Mass

Quantity

Unit

Click on Total:... to rescale the

Nucleonica - Nuclide mixtures - Windows Internet Explorer


http://www.nucleonica.com/Application/NuclideMixtures.aspx

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Nucleonica - Nuclide mixtures

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Version: 2012.06.28 08:29:56



## Nuclide Mixtures

[Getting started](#)  
[Reference manual](#)

My Mixtures Edit Upload **Sample Mixtures**

Select	Sample Mixture Name	Date Modified	Delete
<input type="checkbox"/>	Ce-144 / Pr-144	02.04.2012, 14:06:35	
<input type="checkbox"/>	Cs137 / Ba137m	02.04.2012, 14:07:29	
<input type="checkbox"/>	Fuel element with enriched uranium and ZrH1.6. Total mass is 100 g.	26.06.2012, 13:58:55	
<input type="checkbox"/>	Fukushima spectrum	22.05.2012, 16:35:01	
<input type="checkbox"/>	HEU, highly enriched uranium	06.05.2011, 13:32:54	
<input type="checkbox"/>	I131_Cs137_mixture	14.03.2011, 16:22:45	
<input type="checkbox"/>	Natural Thorium	10.03.2010, 13:36:26	
<input type="checkbox"/>	Natural Uranium	08.04.2010, 15:50:06	
<input type="checkbox"/>	Rb-81/Kr-81m Generator	06.01.2011, 17:03:59	
<input type="checkbox"/>	Reactor Grade Pu Sample	10.05.2011, 13:33:12	
<input type="checkbox"/>	Sr-90 / Y-90	29.03.2012, 14:51:09	
<input checked="" type="checkbox"/>	SRM 071 U isotopes separated 1. July 1977	28.06.2012, 15:19:14	
<input type="checkbox"/>	Transuranics in 1 ton Spent Fuel	10.03.2010, 14:31:18	
<input type="checkbox"/>	U232+Co60	10.03.2010, 13:50:08	

**Send to My Mixtures**



## Nuclide Mixtures

[Getting started](#)  
[Reference manual](#)















My Mixtures

Edit

Upload

Sample Mixtures

### User defined nuclide mixtures

Mixture	Date modified ▼	Download	Delete
<i>(create, upload a new Mixture)</i>			
Natural Potassium	23.10.2012, 13:31:19		
Zircaloy-4	10.09.2012, 19:14:17		
Zirconium hydride ZrH1.6	29.08.2012, 11:35:47		
Element Mg	09.08.2012, 19:19:07		
K and its isotopes	09.08.2012, 14:28:47		
SRM 071 U isotopes separated 1. July 1977	28.06.2012, 15:19:14		
Fuel element with enriched uranium and ZrH1.6. Total mass is 100 g.	26.06.2012, 13:58:55		
Fukushima spectrum	22.05.2012, 16:35:01		
Cs137 / Ba137m	02.04.2012, 14:07:29		
Ce-144 / Pr-144	02.04.2012, 14:06:35		
Sr-90 / Y-90	29.03.2012, 14:51:09		
Reactor Grade Pu Sample	10.05.2011, 13:33:12		
HEU, highly enriched uranium	06.05.2011, 13:32:54		
I131_Cs137_mixture	14.03.2011, 16:22:45		
Rb-81/Kr-81m Generator	06.01.2011, 17:03:59		
Natural Uranium	08.04.2010, 15:50:06		
Transuranics in 1 ton Spent Fuel	10.03.2010, 14:31:18		
U232+Co60	10.03.2010, 13:50:08		
Natural Thorium	10.03.2010, 13:36:26		
All Mixtures (19)			

# Nuclide composition of SRM 071 today

- Decay Engine
- Mixture Selector – SRM 071
- Activity in Bq at creation time  $5.03\text{e}+6$  Bq
- Options Tab – select Date
- Decay Engine tab – date 1 July 1977, today
- Start

Nucleonica - Decay Engine - Windows Internet Explorer

http://www.nucleonica.com/Application/FullDecay.aspx

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Nucleonica - Decay Engine

Logged in as: zsoti (Administrator) Networking Nuclear Science Search Forum Calculator Privacy Legal Logout

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Version: 2012.10.17 08:52:35

 **Decay engine**  
**SRM 071 U isotopes separated 1. July 1977**

Mixture  
SRM 071 U isotopes separated 1. July 1977 Nuclide selector

Decay Engine Options Decay Tree Mixture details

Starting date / time: 01.07.1977 12:00:00  
Final date / time: 23.10.2012 12:13:01  
Time span: 35.3136 Years  
Starting quantity: 5.03e+6  
Final quantity: ???  
Unit: Becquerel

Start Reset

Type of graph: Activities

Calculation details

Number of timesteps: 40  
Accuracy Factor: 1E-02  
Distance (cm): 100  
Number of linear chains: ???

Questions, remarks, suggestions can be posted in the [forum](#)



Nucleonica - Decay Engine - Windows Internet Explorer

http://www.nucleonica.com/Application/FullDecay.aspx

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Nucleonica - Decay Engine

## Decay engine

### SRM 071 U isotopes separated 1. July 1977

Mixture: SRM 071 U isotopes separated 1. July 1977 Nuclide selector

Decay Engine Options Decay Tree Mixture details

Starting date / time: 01.07.1977 12:00:00 Final date / time: 23.10.2012 12:47:54 Time span: 3.53E+01 Years

Starting quantity: 5.03E+06 Final quantity: **1.01E+07** Unit: Becquerel

Calculation details: Number of timesteps: 40 Accuracy Factor: 1E-02 Distance (cm): 100 Number of linear chains: 4

Start Reset Create Nuclide Mixture

Plot	Parent+Daughters	Half-life	N(atoms)	M(g)	A(Bq)	$A_0$ (Bq)	$A_{\mu}$ (Bq)	Ing.Radiat(Sv)	$\gamma$ Dose rate( $\mu$ Sv/h)	Disintegrations
<input checked="" type="checkbox"/>	91 Pa234 m	1.17 m	2.50E+08	9.73E-14	2.47E+06	0	2.47E+06	0	5.78E-03	2.75E+15
<input checked="" type="checkbox"/>	90 Th234	24.09 d	7.42E+12	2.89E-09	2.47E+06	0	2.47E+06	8.40E-03	2.47E-03	2.75E+15
<input checked="" type="checkbox"/>	92 U238	4.5E9 y	5.03E+23	1.99E+02	2.47E+06	2.47E+06	1.09E-05	1.11E-01	2.37E-05	2.75E+15
<input checked="" type="checkbox"/>	92 U234	2.5E5 y	2.73E+19	1.06E-02	2.44E+06	2.44E+06	0	1.20E-01	4.55E-05	2.72E+15
<input checked="" type="checkbox"/>	90 Th231	1.06 d	1.51E+10	5.79E-12	1.14E+05	4.55E-08	1.14E+05	3.87E-05	6.75E-04	1.27E+14
<input checked="" type="checkbox"/>	92 U235	7.0E8 y	3.65E+21	1.42E+00	1.14E+05	1.14E+05	0	5.35E-03	2.43E-03	1.27E+14
<input type="checkbox"/>	90 Th230	7.5E4 y	2.72E+15	1.04E-06	7.93E+02	7.93E+02	0	1.67E-04	4.18E-08	4.42E+11
<input type="checkbox"/>	91 Pa231	3.3E4 y	1.27E+14	4.87E-08	8.50E+01	8.50E+01	0	6.04E-05	6.62E-07	4.74E+10

Nucleonica - Decay Engine - Windows Internet Explorer

http://www.nucleonica.com/Application/FullDecay.aspx

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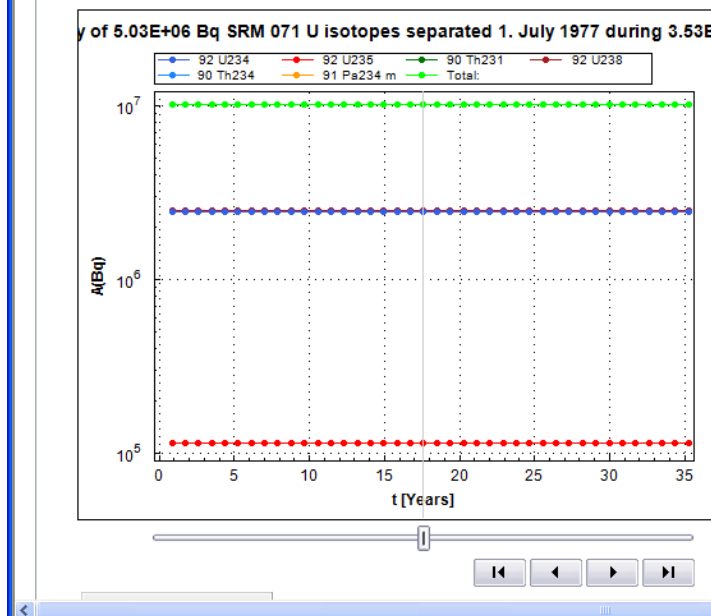
Nucleonica - Decay Engine

5.75E+06 0 0 0 0 0 0 0 0 0 0

2.00E+02 1.01E+07 5.03E+06 5.05E+06 2.45E-01 1.14E-02 5.06E+23

Use field qualifier ("")

Unselect all Nuclides



Type of graph: Activities

Curve	Nuclide	Activity [Bq]	16.8	17.7
	92 U234	2.44e+6	2.44e+6	2.44e+6
	92 U235	1.14e+5	1.14e+5	1.14e+5
	90 Th231	1.14e+5	1.14e+5	1.14e+5
	92 U238	2.47e+6	2.47e+6	2.47e+6
	90 Th234	2.47e+6	2.47e+6	2.47e+6
	91 Pa234 m	2.47e+6	2.47e+6	2.47e+6
	Total:	1.01e+7	1.01e+7	1.01e+7

## SRM 071

- Compute the gamma dose rate at the creation time and today – distance 1 m
- Display gamma lines at the creation time and today
- Dosimetry and Shielding application (no shielding)

Nucleonica - Dosimetry and Shielding - Windows Internet Explorer

http://www.nucleonica.com/Application/Shielding.aspx

Live Search

Nucleonica - Dosimetry and Shielding

Mixture

SRM 071 U isotopes separated 1. July 1977

Nuclide selector

☐ Include daughters

Dosimetry and Shielding

Dose rate/Thickness graph

Options

Mixture details

Initial source strength

Activity(Bq) 5.03E+06

Shielding material

Pb 0 cm

Dose rate ( $\mu\text{Sv/h}$ ) 2.45E-03

Source

Shield

Detector

Source/detector distance (cm) 100

Start

Reset

Half-Value Shield Thickness(cm)	8.00E-02
Tenth-Value Shield Thickness(cm)	2.00E-01
Equivalent Dose Rate Constant $\Gamma$ (mSv·m <sup>2</sup> /GBq·h)	4.88E-04

Nucleonica - Dosimetry and Shielding - Windows Internet Explorer

http://www.nucleonica.com/Application/Shielding.aspx

Live Search

Nucleonica - Dosimetry and Shielding

Number of lines ( $\gamma$ ):	58	$\Sigma \text{P.}(\gamma)$ :	1.49E+05
Number of lines ( $\alpha$ ):	16	$\Sigma \text{P.}(\alpha)$ :	1.75E+04
Number of lines ( $\gamma+\alpha$ ):	74	$\Sigma \text{P.}(\text{total})$ :	1.66E+05

Download

☒ Excel ☐ CSV

Separator: Semicolon (;)

☒ Use field qualifier (")

Nuclide	Half-life	Activity (Bq)	Mass (g)	Tissue $\gamma$ Dose Rate ( $\mu\text{Sv/h}$ )	$\gamma$ Exposure rate ( $\mu\text{Gy/h}$ )
92 U 235	704 My	1.14E+05	1.42E+00	2.39E-03	2.10E-03
92 U 234	245.5 ky	2.44E+06	1.06E-02	4.37E-05	4.18E-05
92 U 238	4.468 Gy	2.47E+06	1.99E+02	2.27E-05	4.22E-05
3 Nuclides	Page: 1 / 1	5.02e+6	2.00e+2	2.46e-3	2.18e-3

Download

☒ Excel ☐ CSV

Separator: Semicolon (;)

☐ Use field qualifier (")

☐ Show radiation details

SRM 071 U isotopes separated 1. July 1977: Gamma and X-rays spectrum

92 U 235 92 U 234 92 U 238

# Include daughters

## Cooling Time 35.7 y

Nucleonica - Dosimetry and Shielding - Windows Internet Explorer

http://www.nucleonica.com/Application/Shielding.aspx

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Nucleonica - Dosimetry and Shielding

### Dosimetry and Shielding

SRM 071 U isotopes separated 1. July 1977

Mixture  
SRM 071 U isotopes separated 1. July 1977 Nuclide selector

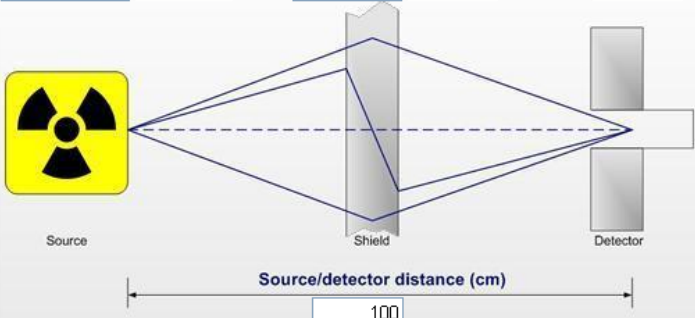
☒ Include daughters "Cooling" time 35.3 Years

Dosimetry and Shielding Dose rate/Thickness graph Options Mixture details

**Initial source strength** Activity(Bq) 5.03E+06

**Shielding material** Pb 0 cm

**Dose rate ( $\mu\text{Sv/h}$ )** ???



Source/detector distance (cm) 100

Start Reset



## Dosimetry and Shielding

### SRM 071 U isotopes separated 1. July 1977

Mixture

Nuclide selector

SRM 071 U isotopes separated 1. July 1977

☒ Include daughters

"Cooling" time

32.7

Years

Dosimetry and Shielding

Dose rate/Thickness graph

Options

Mixture details

Initial source strength

Activity(Bq) 5.03E+06

Shielding material

Pb 0 cm

Dose rate ( $\mu\text{Sv/h}$ )

???



Source



Shield



Detector

Source/detector distance (cm)

100

Start

Reset

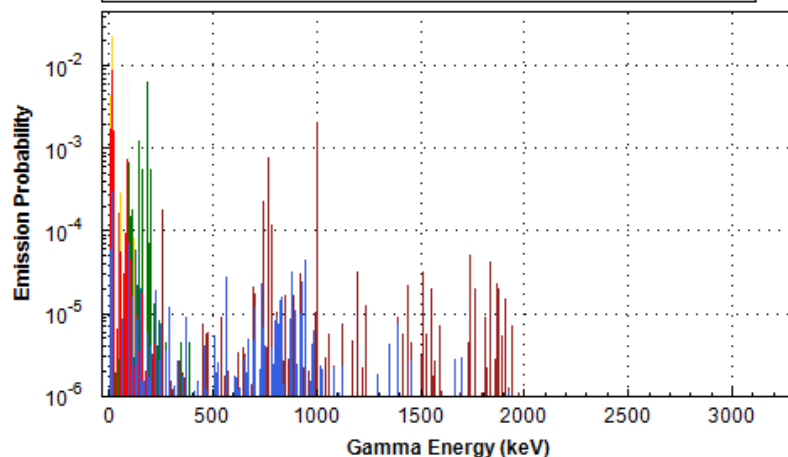
88 Ra 226	1.600 ky	5.92E+00	1.62E-10	5.58E-09	4.88E-09
87 Fr 223	22.00 m	4.61E-01	3.22E-19	4.14E-09	3.96E-09
89 Ac 227	21.772 y	3.34E+01	1.25E-11	1.21E-09	1.31E-09
28 Nuclides	Page: 1 / 2	1.01e+7	2.00e+2	1.20e-2	1.17e-2

Download Excel CSV Separator: Semicolon (;) Use field qualifier (")

Show radiation details

### 71 U isotopes separated 1. July 1977: Gamma and X-rays after 35 Years c

91 Pa 234	90 Th 231	92 U 235	83 Bi 214
90 Th 227	91 Pa 231	82 Pb 214	87 Fr 223
88 Ra 223	82 Pb 210	83 Bi 211	86 Rn 219
92 U 234	90 Th 234	92 U 238	90 Th 230
82 Pb 211	88 Ra 226	89 Ac 227	91 Pa 234m
81 Ti 207	86 Rn 222	84 Po 210	84 Po 218
83 Bi 210			



Show Graph Settings

Gamma lines without daughters

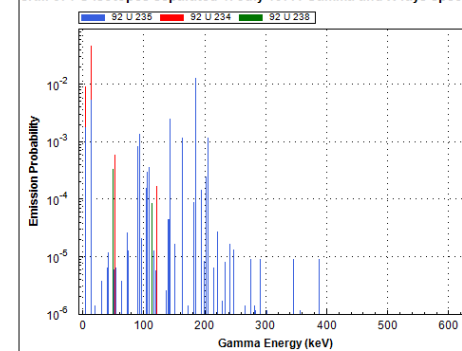
Number of lines (γ):	58	Σ E P (γ):	1.49E+05
Number of lines (X):	16	Σ E P (X):	1.75E+04
Number of lines (γ+X):	74	Σ E P (total):	1.66E+05

Download Excel CSV Separator: Semicolon (;) Use field qualifier (")

Nuclide	Half-life	Activity (Bq)	Mass (g)	Tissue γ Dose Rate (μSv/h)	γ Exposure rate (μGy/h)
92 U 235	704 My	1.14E+05	1.42E+00	2.39E-03	2.10E-03
92 U 234	245.5 ky	2.44E+06	1.06E-02	4.37E-05	4.18E-05
92 U 238	4.468 Gy	2.47E+06	1.99E+02	2.27E-05	4.22E-05
3 Nuclides	Page: 1 / 1	5.02e+6	2.00e+2	2.46e-3	2.18e-3

Download Excel CSV Separator: Semicolon (;) Use field qualifier (")

### SRM 071 U isotopes separated 1. July 1977: Gamma and X-rays spectrum



Nucleonica - Dosimetry and Shielding - Windows Internet Explorer

http://www.nucleonica.com/Application/Shielding.aspx

Live Search

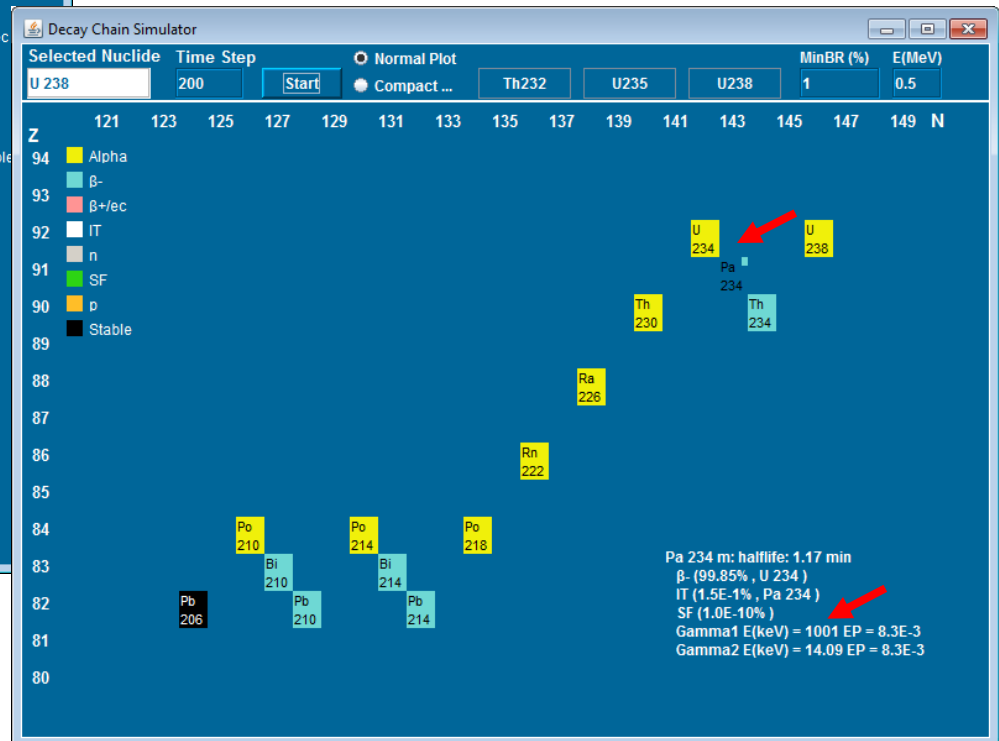
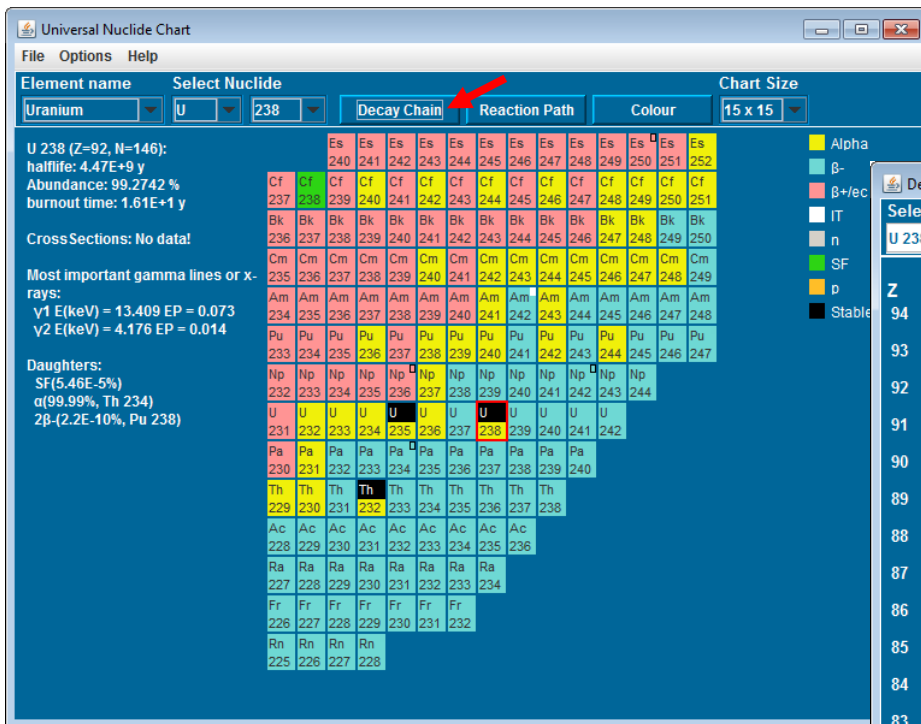
Nucleonica - Dosimetry and Shielding

Page Safety Tools

Nuclide	Gamma Energy (keV)	Emission Probability P (per disintegration)	Mass Attenuation Coefficient (shielding)(cm <sup>2</sup> /g)	Number of Mean Free Paths (μ-d)	Build-up Factor	Mass Absorption Coefficient (tissue)(cm <sup>2</sup> /g)	Issue γ Dose Rate(μSv/h)	γ Exposure Rate(μGy/h)
91 Pa 234m	1001.02	2.04E-03	0.00E+00	0.00E+00	1.00E+00	3.07E-02	2.91E-03	2.64E-03
92 U 235	185.714	6.44E-03	0.00E+00	0.00E+00	1.00E+00	2.89E-02	1.60E-03	1.39E-03
91 Pa 234m	766.358	7.81E-04	0.00E+00	0.00E+00	1.00E+00	3.19E-02	8.85E-04	8.17E-04
90 Th 234	63.3	9.06E-03	0.00E+00	0.00E+00	1.00E+00	3.13E-02	8.32E-04	7.98E-04
90 Th 234	92.38	6.42E-03	0.00E+00	0.00E+00	1.00E+00	2.57E-02	7.07E-04	6.58E-04
90 Th 234	92.8	6.34E-03	0.00E+00	0.00E+00	1.00E+00	2.57E-02	7.02E-04	6.54E-04
90 Th 231	25.64	1.65E-03	0.00E+00	0.00E+00	1.00E+00	2.63E-01	5.14E-04	1.17E-03
91 Pa 234m	742.814	2.29E-04	0.00E+00	0.00E+00	1.00E+00	3.20E-02	2.52E-04	2.32E-04
92 U 235	143.76	1.23E-03	0.00E+00	0.00E+00	1.00E+00	2.73E-02	2.24E-04	1.94E-04
92 U 235	205.31	5.65E-04	0.00E+00	0.00E+00	1.00E+00	2.95E-02	1.59E-04	1.44E-04
91 Pa 234m	786.272	1.19E-04	0.00E+00	0.00E+00	1.00E+00	3.18E-02	1.38E-04	1.27E-04
92 U 235	163.36	5.72E-04	0.00E+00	0.00E+00	1.00E+00	2.81E-02	1.21E-04	1.08E-04
91 Pa 234m	1737.8	5.19E-05	0.00E+00	0.00E+00	1.00E+00	2.69E-02	1.12E-04	1.06E-04
91 Pa 234m	98.439	8.41E-04	0.00E+00	0.00E+00	1.00E+00	2.55E-02	9.80E-05	9.18E-05
91 Pa 234m	1831.7	4.23E-05	0.00E+00	0.00E+00	1.00E+00	2.65E-02	9.51E-05	9.11E-05
90 Th 234	112.81	5.98E-04	0.00E+00	0.00E+00	1.00E+00	2.61E-02	8.15E-05	7.30E-05
90 Th 231	84.214	7.57E-04	0.00E+00	0.00E+00	1.00E+00	2.60E-02	7.69E-05	7.10E-05
92 U 235	93.35	6.66E-04	0.00E+00	0.00E+00	1.00E+00	2.57E-02	7.41E-05	6.91E-05
91 Pa 234m	258.2	1.80E-04	0.00E+00	0.00E+00	1.00E+00	3.08E-02	6.62E-05	5.79E-05
91 Pa 234m	1510.1	3.19E-05	0.00E+00	0.00E+00	1.00E+00	2.80E-02	6.26E-05	5.68E-05
91 Pa 234	946.002	4.43E-05	0.00E+00	0.00E+00	1.00E+00	3.10E-02	6.01E-05	5.59E-05
91 Pa 234m	94.665	5.21E-04	0.00E+00	0.00E+00	1.00E+00	2.57E-02	5.86E-05	5.47E-05
91 Pa 234m	1193.77	3.21E-05	0.00E+00	0.00E+00	1.00E+00	2.97E-02	5.27E-05	4.94E-05
91 Pa 234m	1868	2.25E-05	0.00E+00	0.00E+00	1.00E+00	2.63E-02	5.12E-05	4.94E-05
91 Pa 234m	1875.2	1.96E-05	0.00E+00	0.00E+00	1.00E+00	2.63E-02	4.48E-05	4.32E-05
92 U 235	89.953	4.09E-04	0.00E+00	0.00E+00	1.00E+00	2.58E-02	4.40E-05	4.09E-05
91 Pa 234m	1765.8	2.00E-05	0.00E+00	0.00E+00	1.00E+00	2.68E-02	4.39E-05	4.16E-05
91 Pa 234m	1435.4	2.27E-05	0.00E+00	0.00E+00	1.00E+00	2.84E-02	4.29E-05	4.02E-05
91 Pa 234	883.237	3.17E-05	0.00E+00	0.00E+00	1.00E+00	3.13E-02	4.06E-05	3.74E-05
91 Pa 234m	922	3.03E-05	0.00E+00	0.00E+00	1.00E+00	3.11E-02	4.02E-05	3.72E-05
1493 Radiations	Page: 1 / 50						1.20e-2	1.17e-2

1493 Radiations

# Pa-234m is a daughter of U-238





# **Gamma spectrum of SRM 071**

Create the gamma spectrum of SRM 071 -

- after separation
- 35 years later

Compare those with Cambio File Converter

# Gamma Spectrum Generator without daughter products

- Start the Gamma Spectrum Generator application
- Total activity  $5.026 \times 10^6$  Bq
- Detector HPGe 50 %
- Measurement time 1 h
- Start



# Gamma Spectrum Generator

## SRM 071 U isotopes separated 1. July 1977

Actual chart: Karlsruhe

[Getting started](#)  
[Reference manual](#)

[Questions, remarks, suggestions](#)  
can be posted in the forum

Nuclide Mixtures:

SRM 071 U isotopes separated 1. July 1977

[Nuclide Selector](#)

Total activity:

Bequerel

5.026e+006

Reference point:

Measurement start

Measurement setup

Calculation results

Options

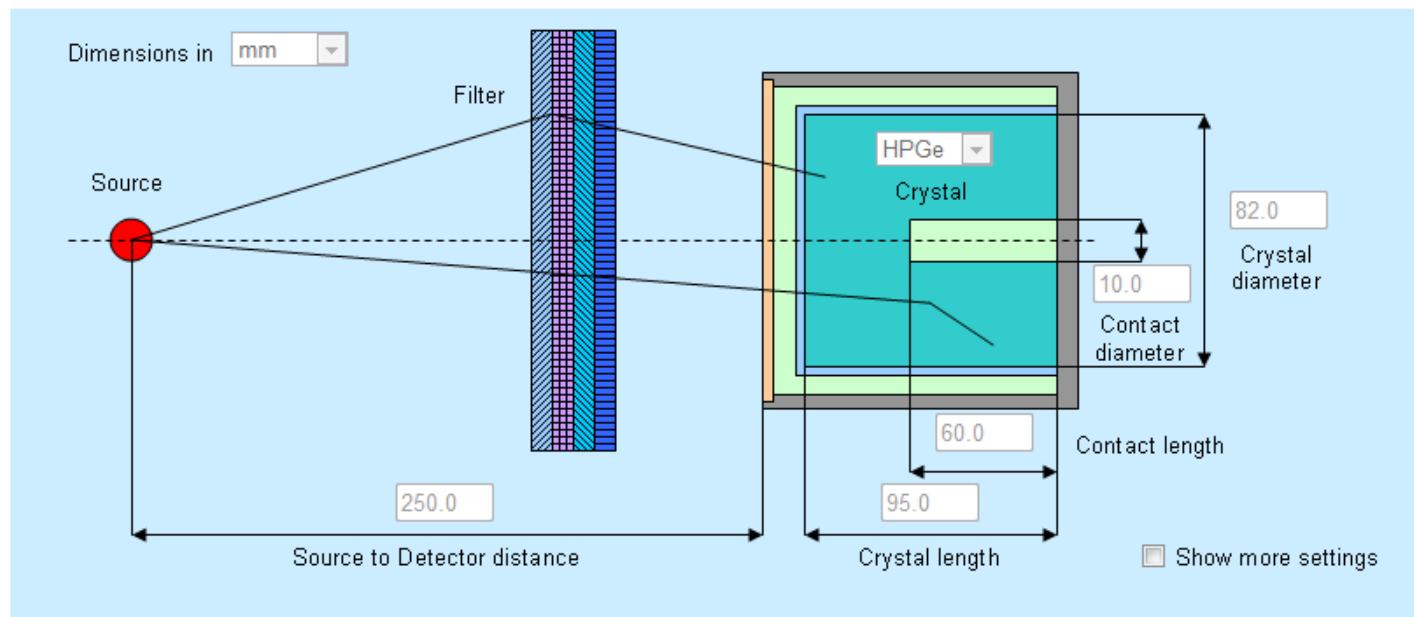
Measurement time: hour 1

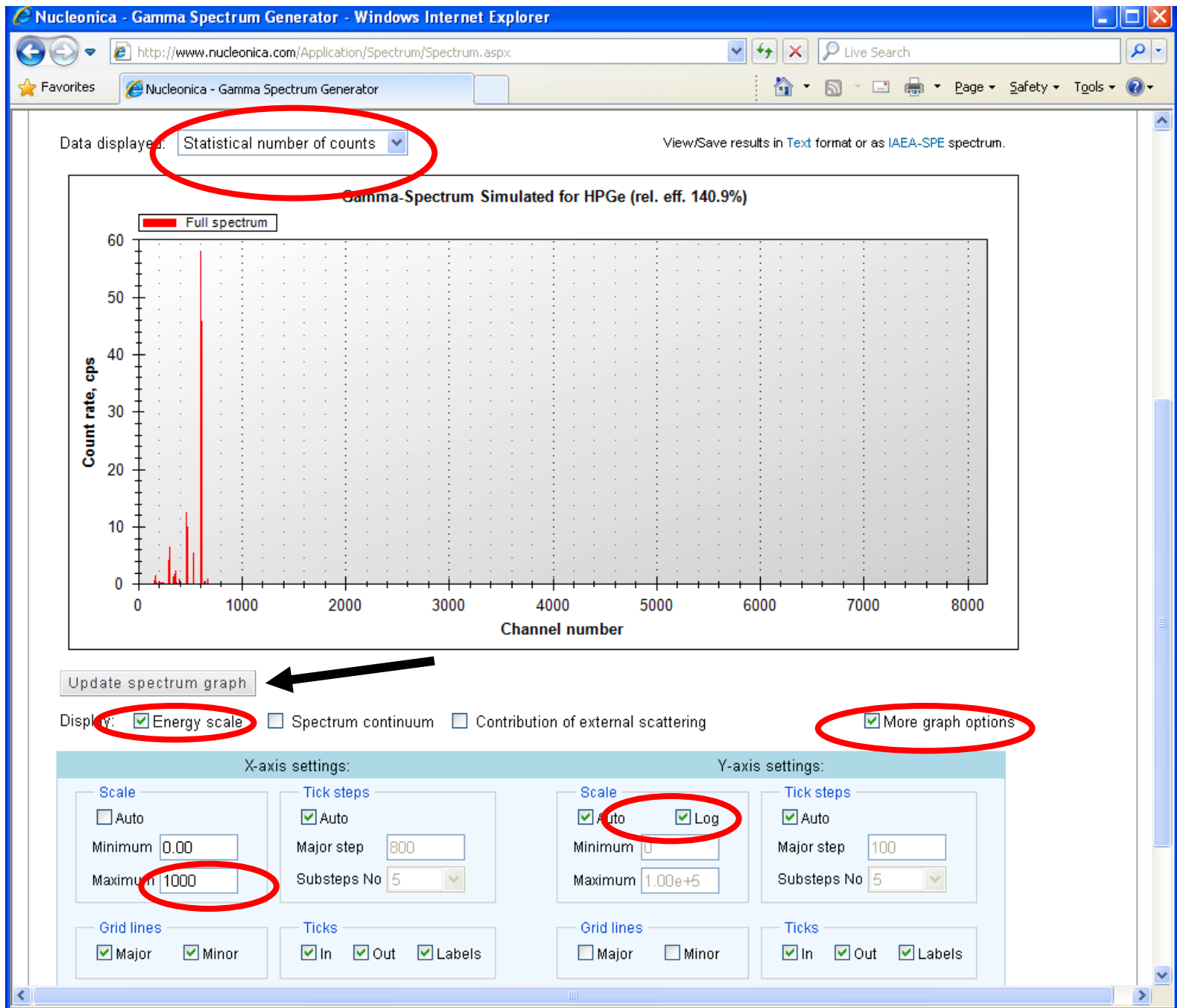
Start

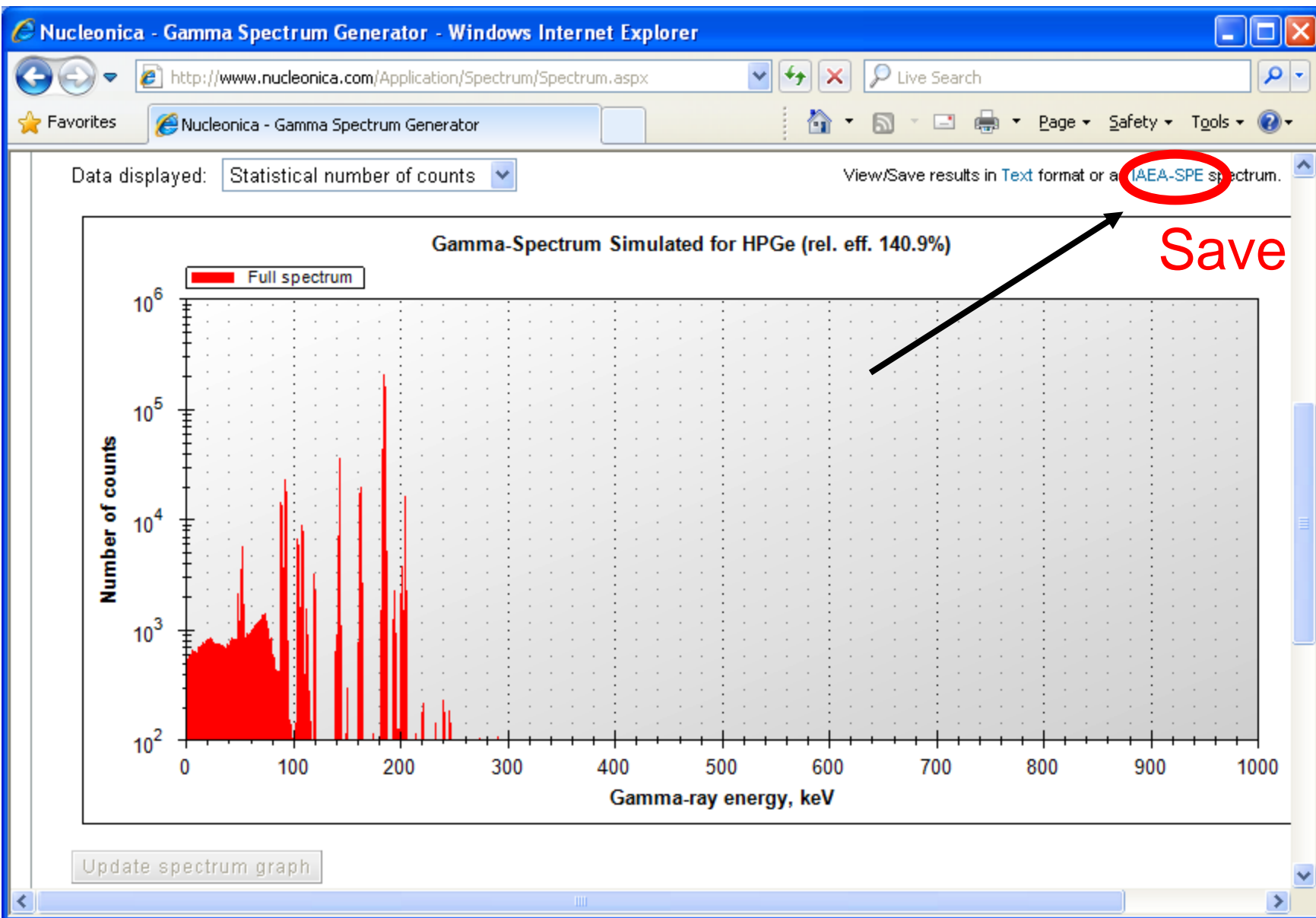
Current configuration: HPGe, coaxial, p-type, rel. eff. 150% (default)

Save as

Delete

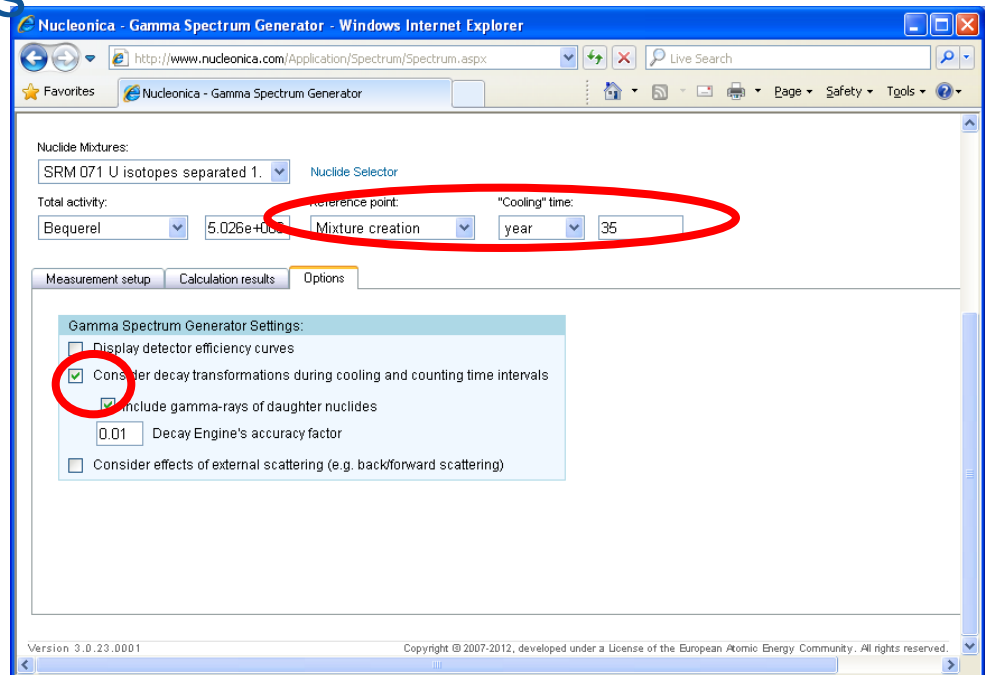


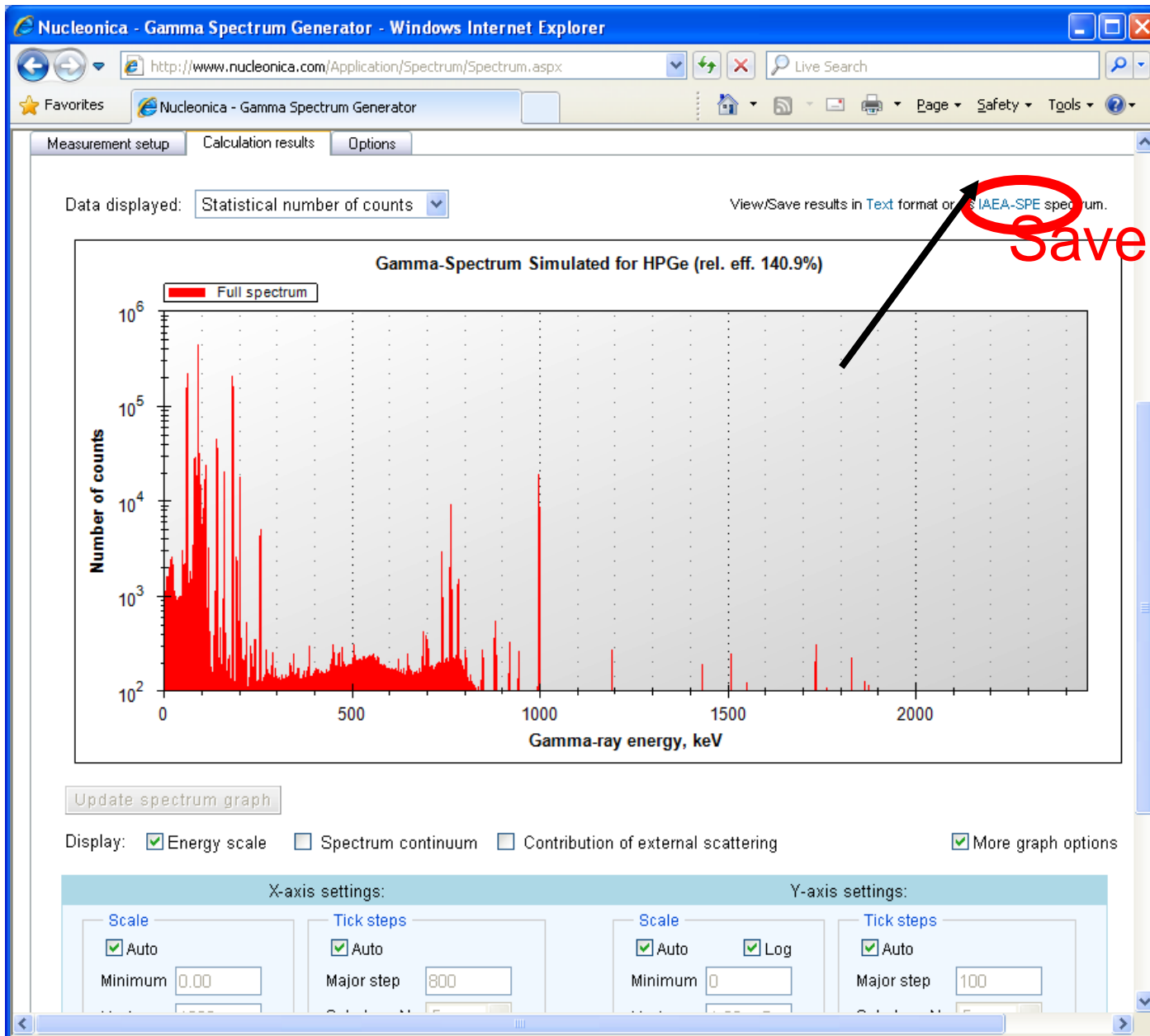




# 35 years later – with daughters

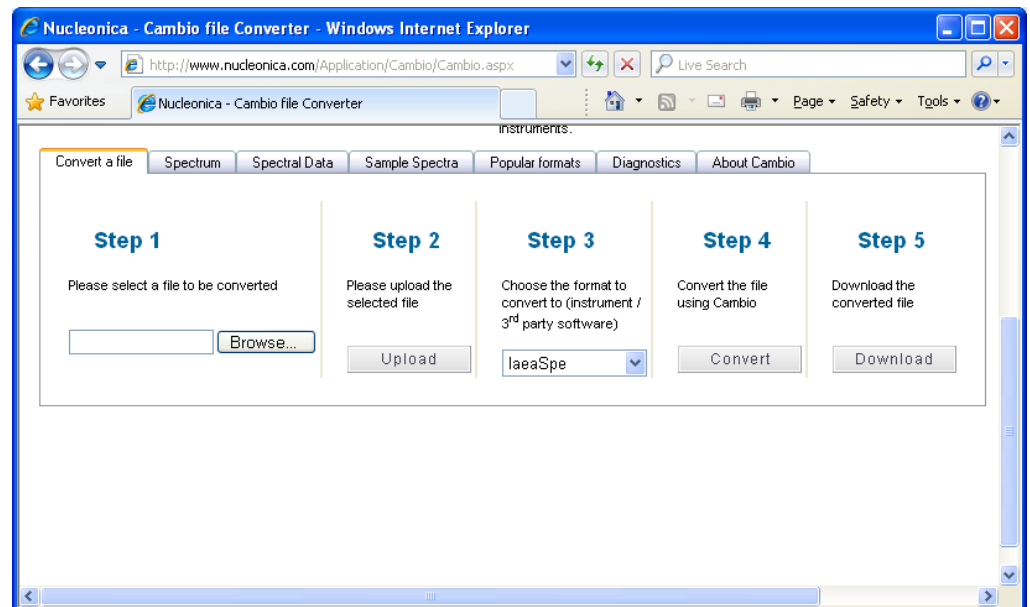
- Options tab
- Consider decay transformations
- Mixture creation
- Cooling time 35 years
- Measurement setup
- Start





# Compare with Cambio File Converter

- Compare spectra with Cambio Module
- Upload both
- Go to the Spectrum Tab





Convert a file

Spectrum

Spectral Data

Sample Spectra

Popular formats

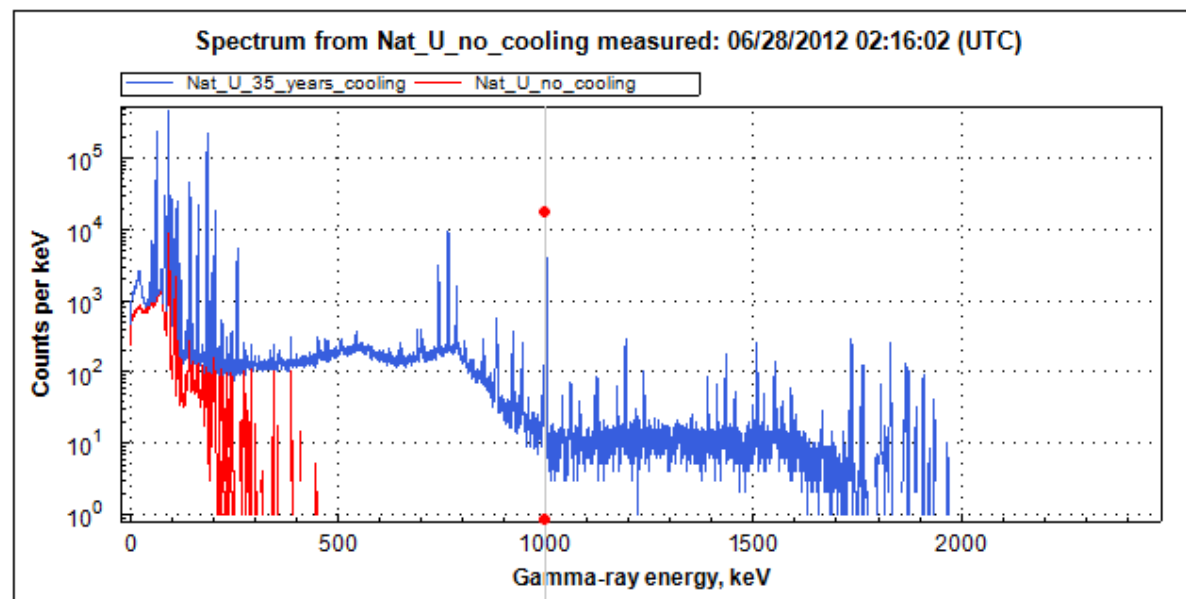
Diagnostics

About Cambio

☒ Nat\_U\_no\_cooling.spe☒ Nat\_U\_35\_years\_cooling.spe

Update

Delete All



Spectral data at cursor position

Energy, keV	Channel	Counts/keV
1000.650	3335	1.78340e+4
996.450	3321	0.00000e+0

Show Graph Settings

Gamma Lines near cursor (from standard.lib, 580 lines)

Nuclide	Decay	Half-life	Energy, keV	Emission Probability (%)
Ac228	β-	6.13 h	968.97	1.742E01
Pa234	β-	1.17 m	1000.99	6.518E-01

# Working with Reference Materials

- Nuclide Mixtures – Create the SRM mixture
- Decay Engine – Nuclide composition today (or any other date)
- Decay Engine – Activity at creation time and today or any other date
- Dosimetry & Shielding – dose rate, gamma lines at creation time and today
- GSG – Gamma spectra at creation time and today
- Cambio File Converter to compare

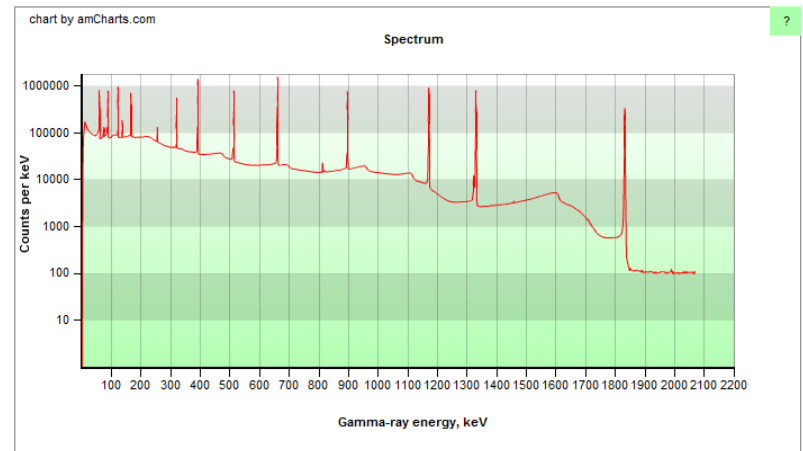
# Nuclide Identification based on Gamma Lines

To solve:

Given a Gamma Spectrum. Which nuclides were the gamma sources?

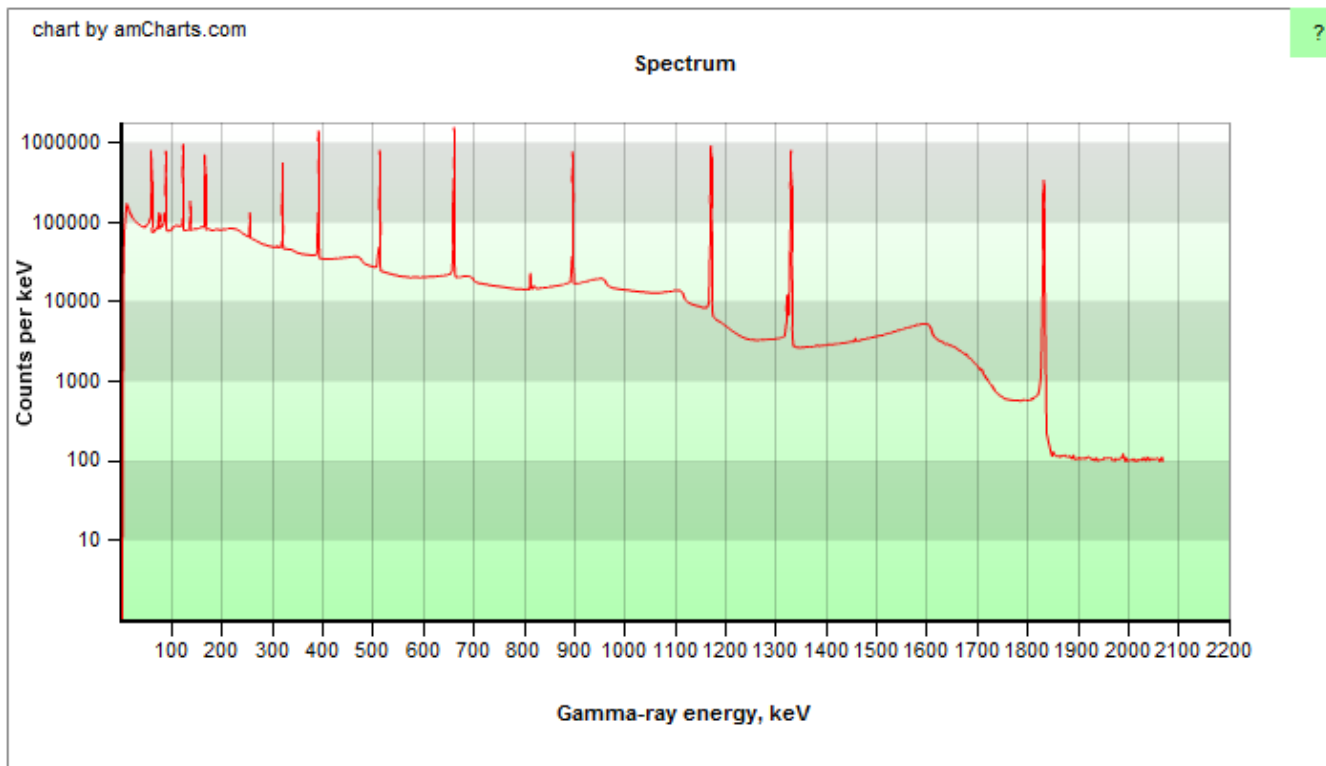
We work with "Peak Identification".

Select a peak -> Find a nuclide!



# WESPA – WEb based SPectrum Analyser

Upload a Gamma Spectrum (or select a Sample Spectrum to analyse)



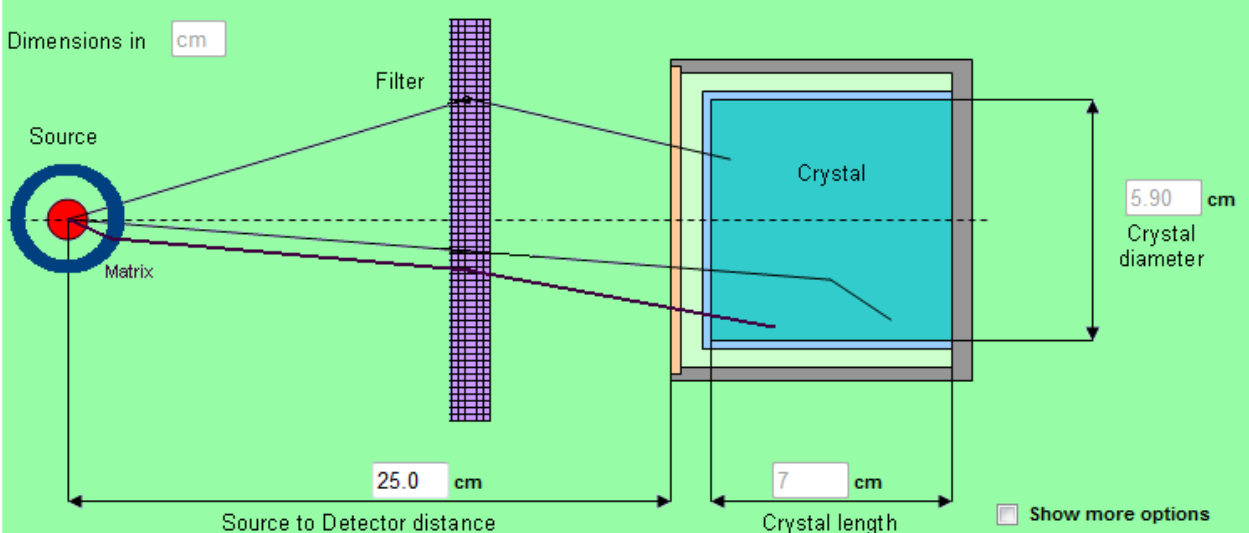
# Measurement Setup

Select the type of detector (because of the resolution)

Step 1 - Upload spectrum Step 2 - Measurement setup Step 3 - Peak analysis

Detector type:

Dimensions in



The diagram illustrates the measurement setup. A source (red dot) is positioned within a matrix (blue circle). A filter (purple grid) is placed between the source and the crystal (blue rectangle). The source-to-detector distance is 25.0 cm. The crystal length is 7 cm. The crystal diameter is 5.90 cm. A 'Show more options' checkbox is present.

Source to Detector distance: 25.0 cm

Crystal length: 7 cm

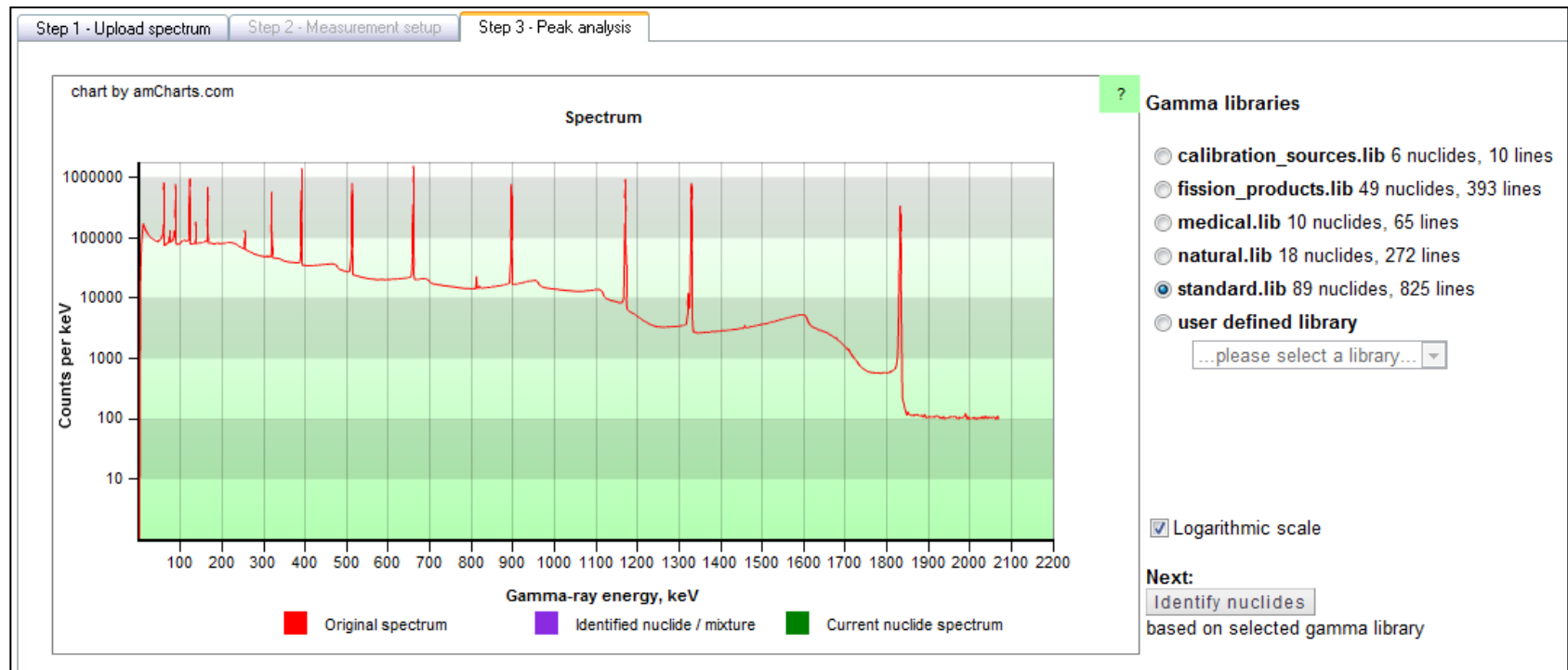
Crystal diameter: 5.90 cm

☐ Show more options

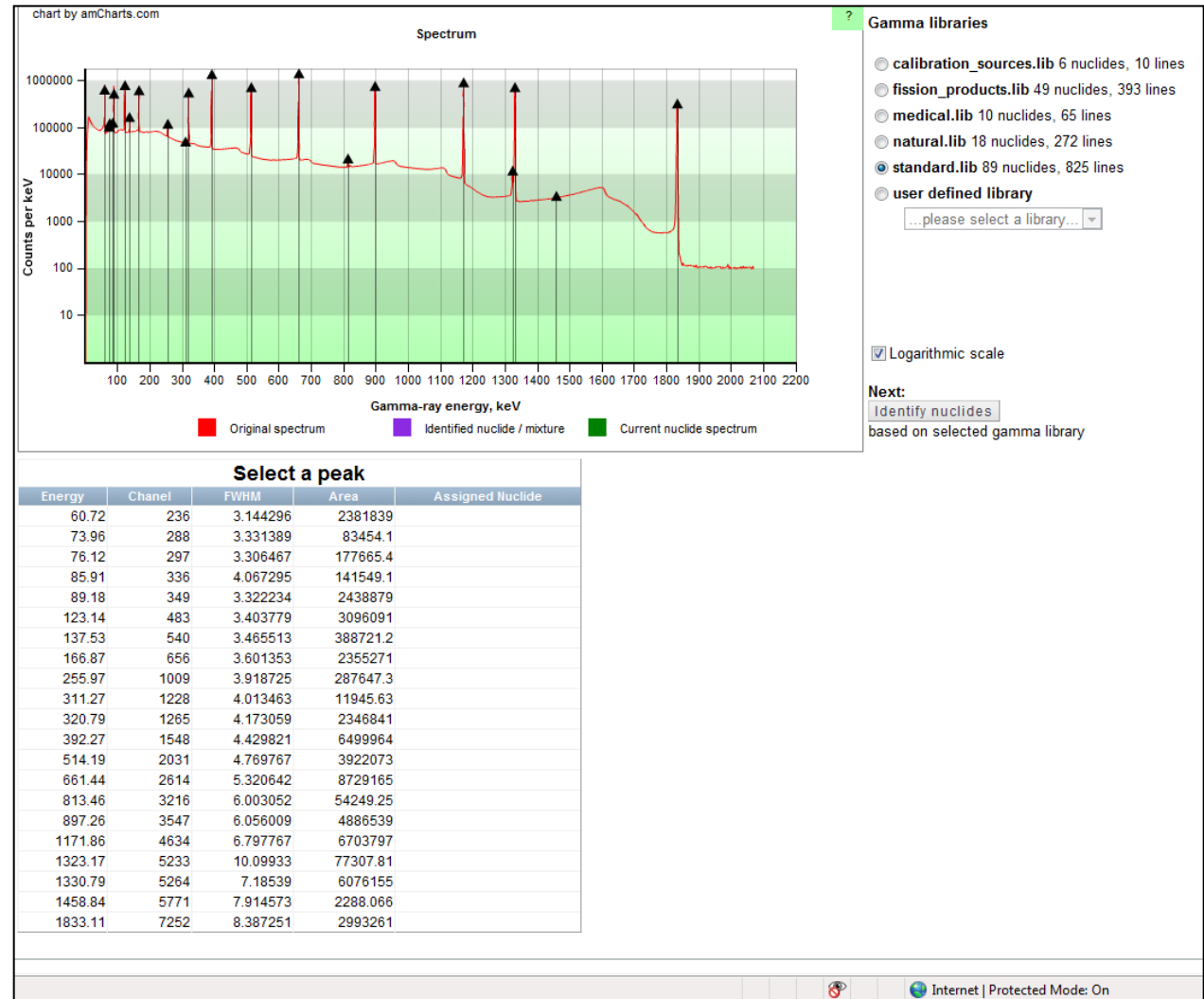
Next:

# Peak Analysis

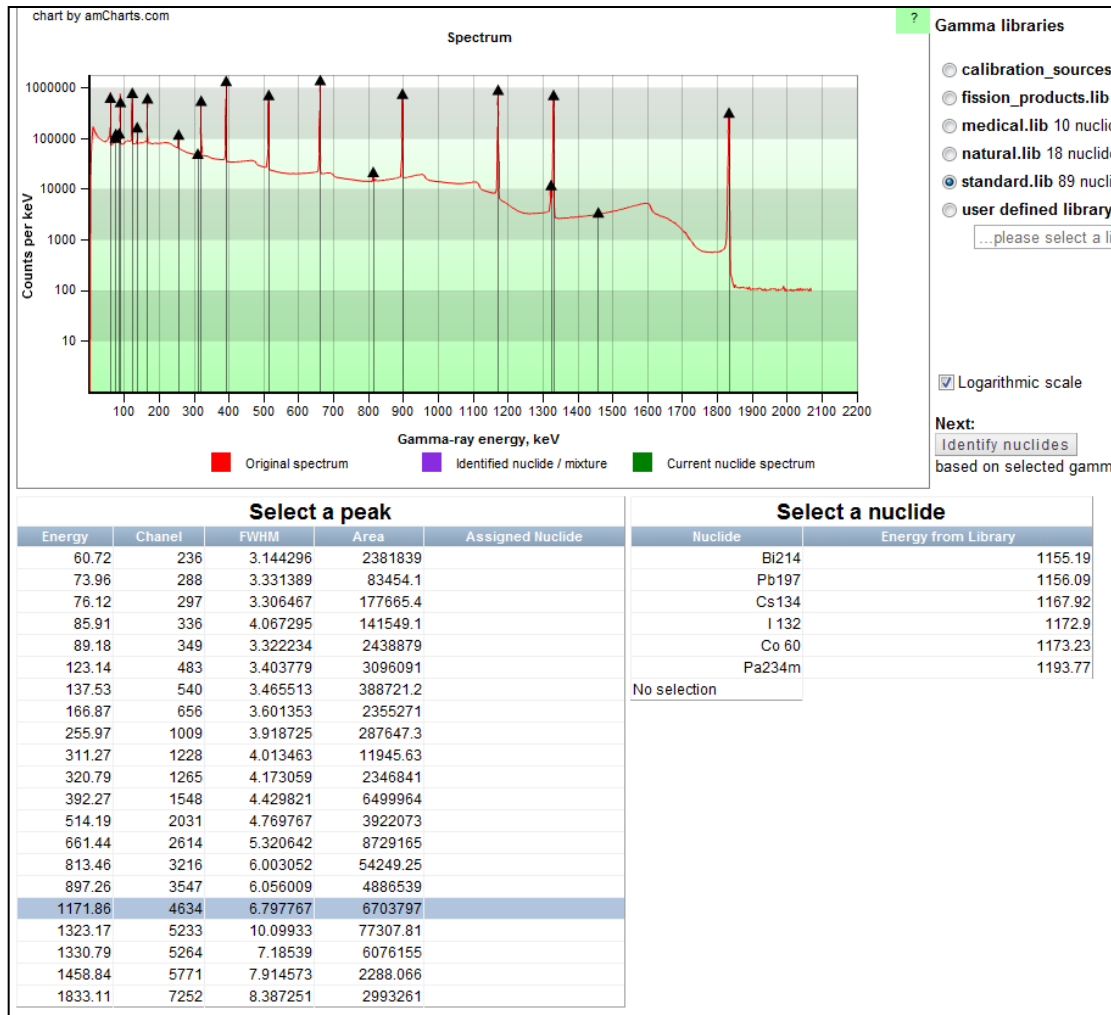
Select a gamma library to reduce the potential gamma lines



# List the peaks



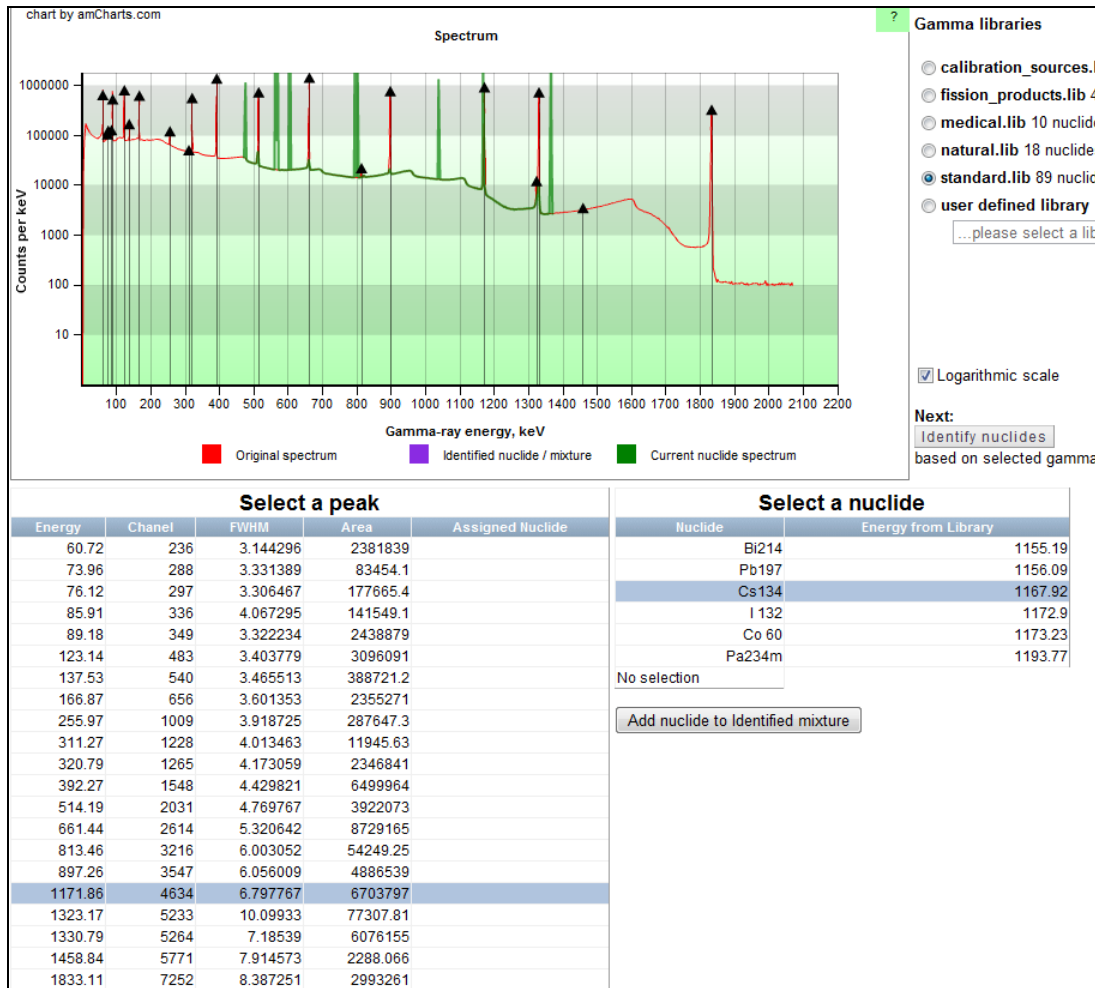
# Select a peak



Potential mixture  
candidates



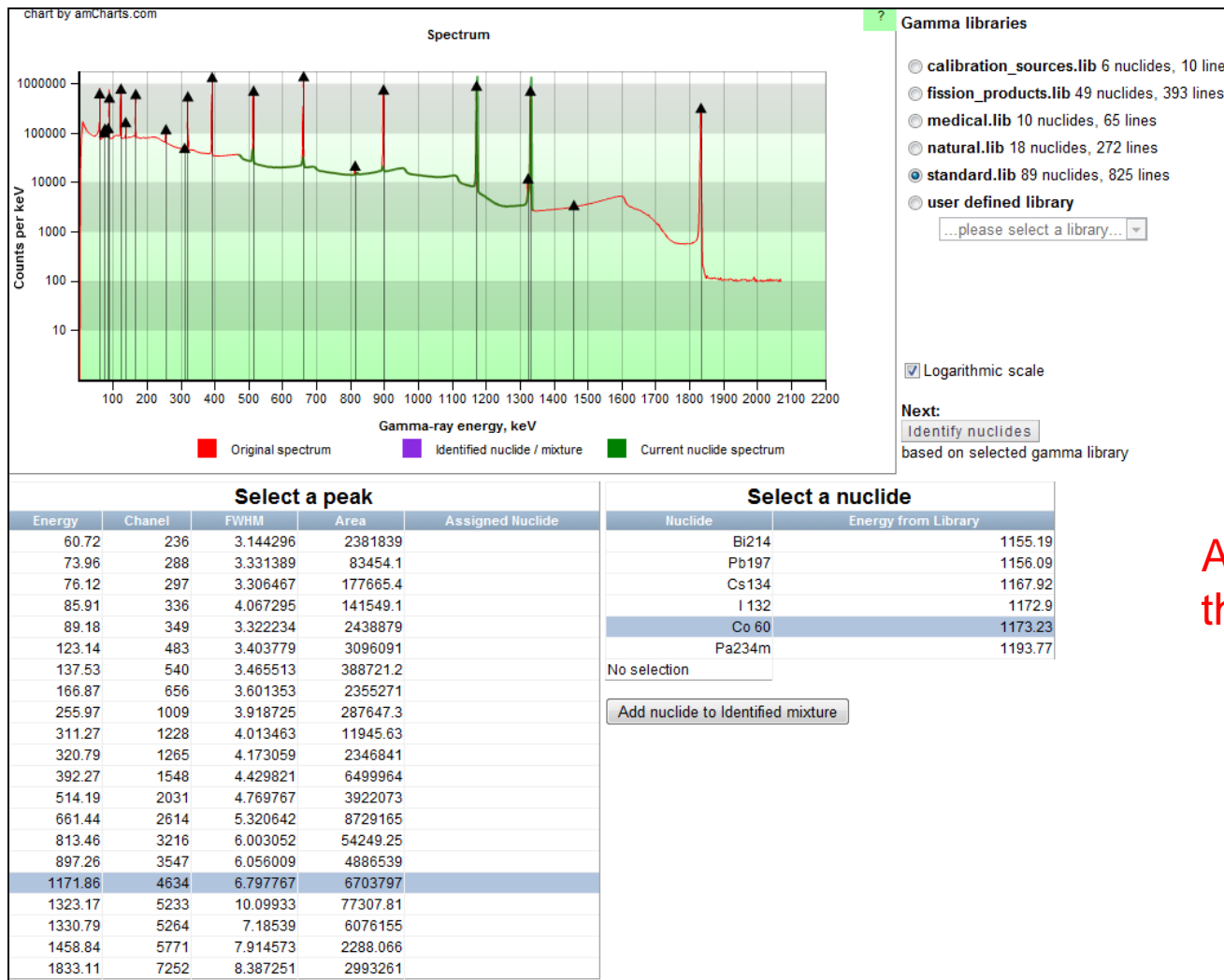
# Select a nuclide



The green curve is the potential fit!

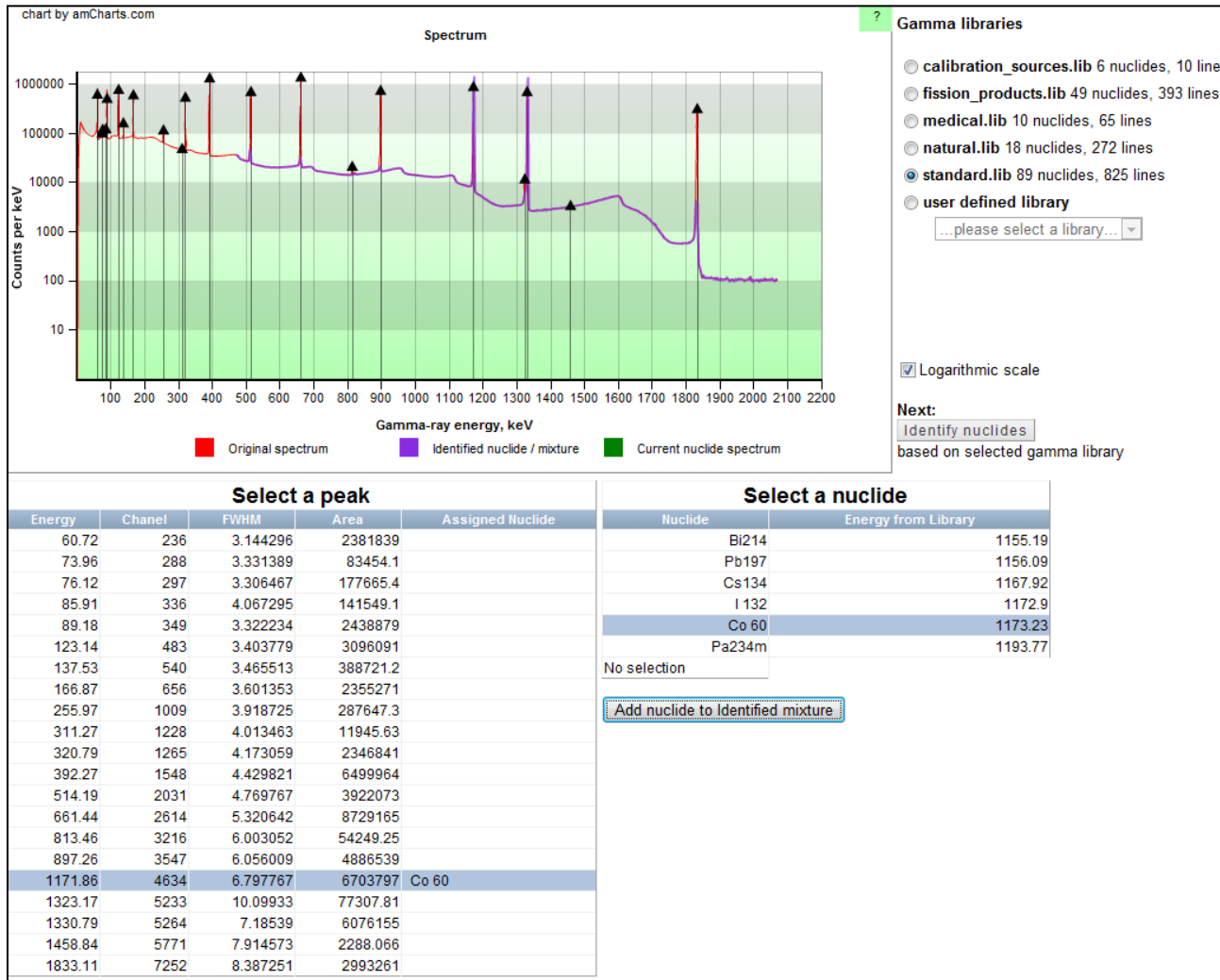
In this case this fit is Not really good we can find something better.

# Find the best fit



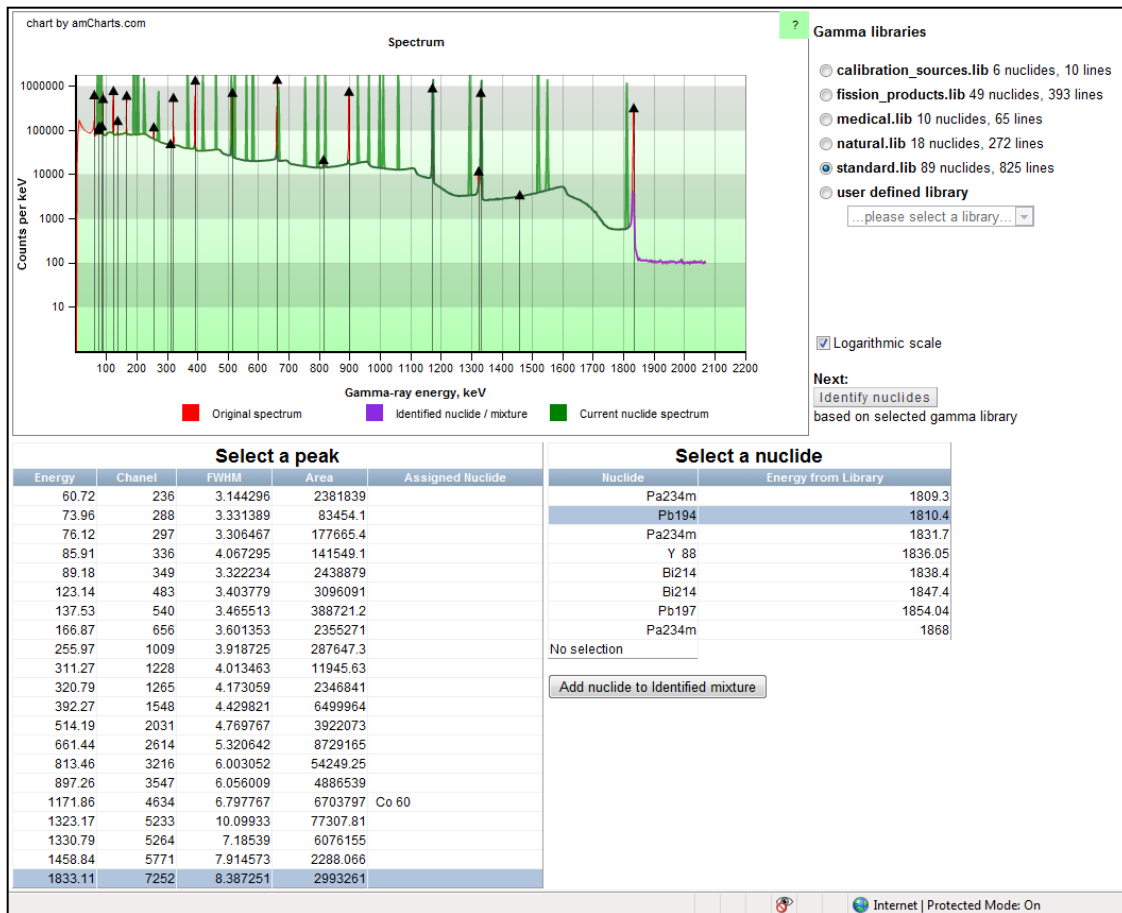
Add the nuclide to  
the mixture!

# The cumulative fit – colour Magenta



Go to the next peak!

# Next candidate nuclide – green curve

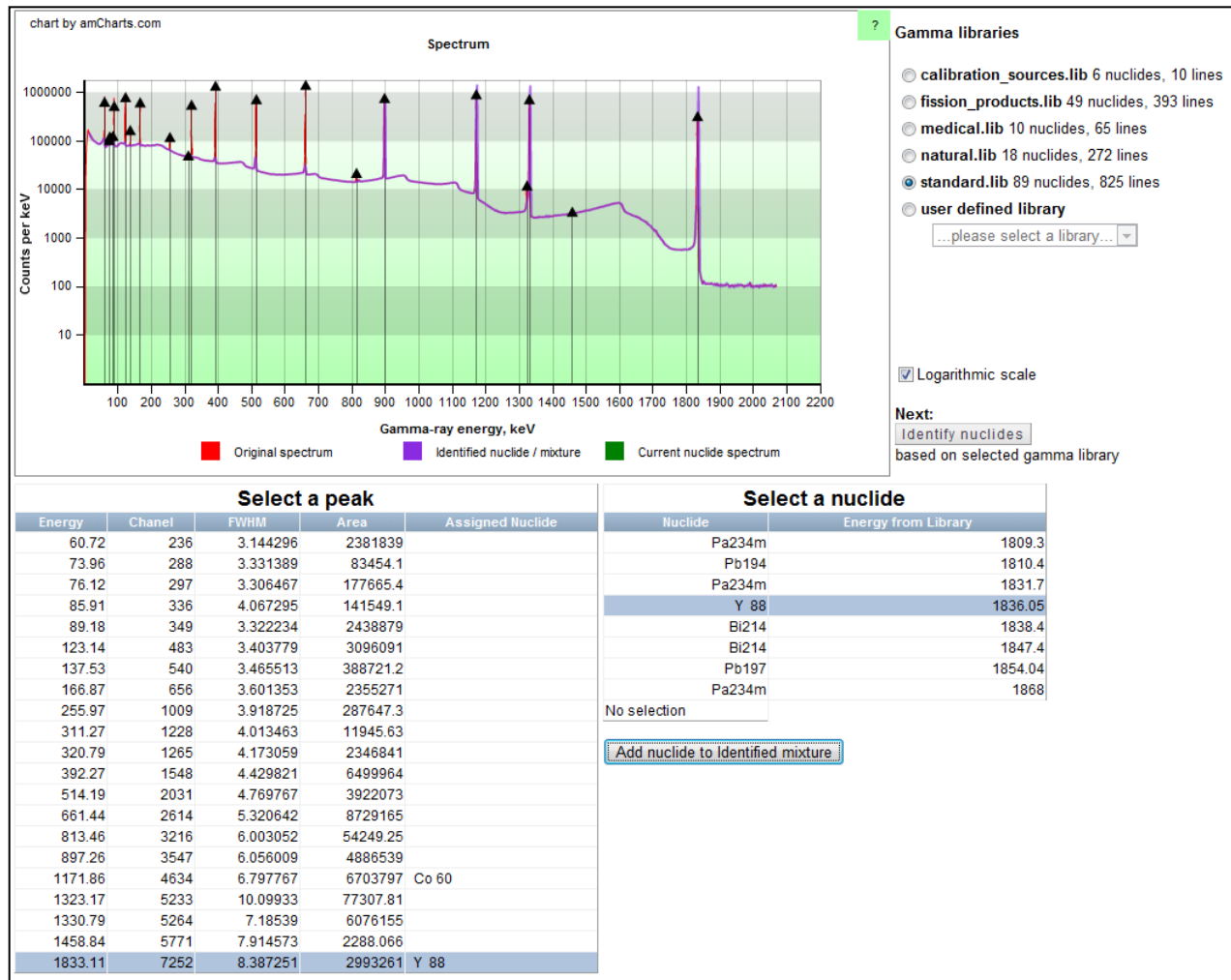


Check the overall fit!

Find a nuclide that fits well

Add to the Identified mixture

...and so on...



# Exercise

Analyse the Sample-6 spectrum in WESPA2 module.

## Application Centre

- » Mass Activity Calculator
- » **New:** Mass Activity Converter
- » Decay Engine
- » **New:** Decay Engine++
- » Dosimetry & Shielding
- » Range & Stopping Power
- » In Silico Dosimetry
- » webKORIGEN
- » Decay Engine for Large Nuclide Sets
- » Universal Nuclide Chart
- » Transport & Packaging
- » **New:** e-Ship: radiological transport assistant
- » Nuclide mixtures
- » Nucleonica Scripting
- » Gamma Spectrum Generator
- » Gamma Spectrum Generator Pro
- » Virtual Cloud Chamber
- » Cambio file Converter
- » WESPA
- » **New:** WESPA2 ←
- » Gamma Library
- » webGraph

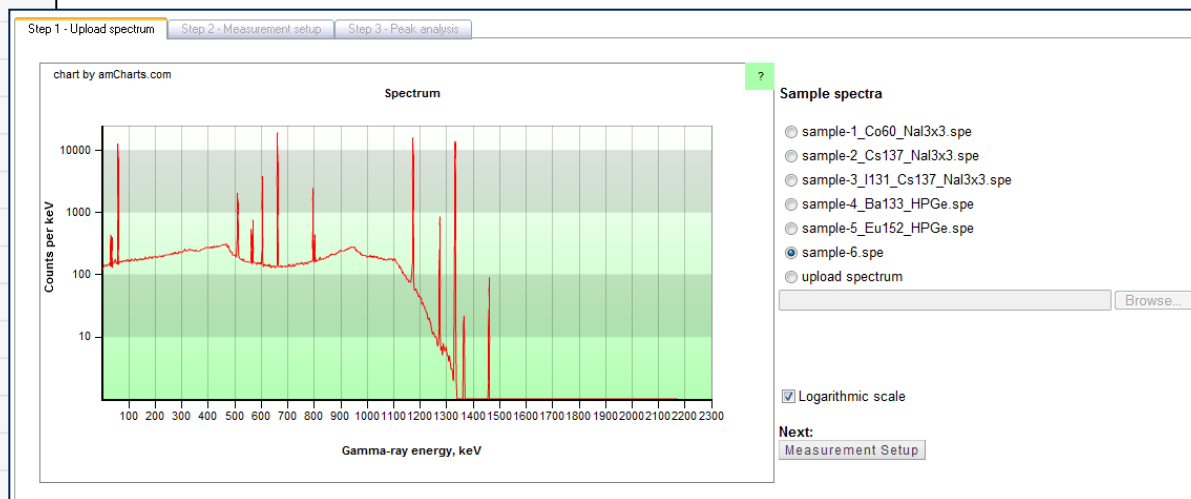
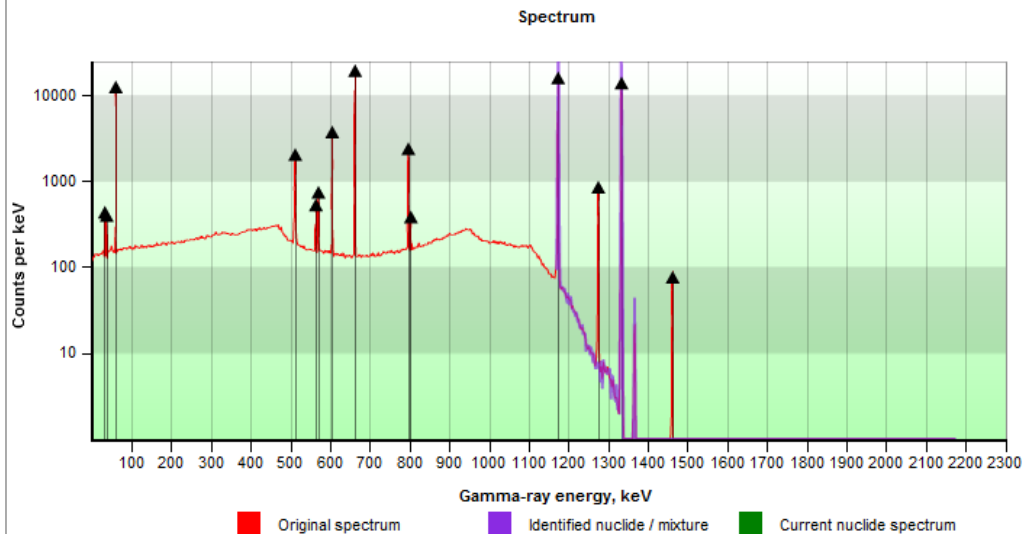


chart by amCharts.com



?

#### Gamma libraries

- ☐ calibration\_sources.lib 6 nuclides, 10 lines
- ☐ fission\_products.lib 49 nuclides, 393 lines
- ☐ medical.lib 10 nuclides, 65 lines
- ☐ natural.lib 18 nuclides, 272 lines
- ☒ standard.lib 89 nuclides, 825 lines
- ☐ user defined library

...please select a library...

☒ Logarithmic scale

Next:

Identify nuclides

based on selected gamma library

#### Select a peak

Energy	Chanel	FWHM	Area	Assigned Nuclide
32.03	106	2.676857	903.6152	
36.39	121	1.994588	577.1438	
59.54	198	2.319897	30951.76	
510.96	1703	7.799284	13205.9	
563.22	1877	4.38283	1558.769	
569.33	1897	4.364946	2826.421	
604.69	2015	4.489281	17272.72	
661.65	2205	4.618011	96165.3	
795.84	2653	5.003412	12459.56	
801.91	2674	5.03609	1297.72	
1173.22	3910	5.709864	98992.53	
1274.54	4248	5.948134	5201.409	
1332.49	4441	6.01241	90649.08	Co 60
1460.87	4869	6.707465	558.7351	

#### Select a nuclide

Nuclide	Energy from Library
Br 82	1317.48
Sb124	1325.51
Co 60	1332.49
Sb124	1355.11
No selection	

Add nuclide to Identified mixture

